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# RCRA FACILITY INVESTIGATION REPORT

## CENTURY ALUMINIUM OF WEST VIRGINIA, INC. RAVENSWOOD, WEST VIRGINIA

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# Acronyms

| | |
|---|---|
| 1,1-DCA | 1,1-Dichloroethane |
| BEHP | Bis(2-ethylhexyl)phthalate |
| CAWV | Century Aluminum of West Virginia, Inc. |
| CDI | Chronic daily intake |
| CLP | Contract Laboratory Program |
| CMS | Corrective Measures Study |
| CPSLs | Conservative Preliminary Screening Levels |
| D&M | Dames & Moore |
| DAF | Dilution-attenuation factor |
| DCC | Description of Current Conditions |
| EPDM | Ethylene propylene diene monomer |
| FRP | Fiberglass reinforced plastic |
| G&M | Geraghty & Miller, Inc. |
| GISLs | Generic Industrial Screening Levels |
| gpm | Gallons per minute |
| HDPE | High density polyethylene |
| HI | Hazard index |
| ICM | Interim Corrective Measures |
| IM | Interim measures |
| IRIS | Integrated Risk Information System |
| ITC | IT Corporation |
| KACC | Kaiser Aluminum and Chemical Company |
| MCL | Maximum Contaminant Levels |
| MCLGs | Maximum Contaminant Level Goals |
| mgd | Million gallons per day |
| MS | Matrix spike |

| | |
|---|---|
| MSL | Mean sea level (MSL) |
| NPDES | National Pollutant Discharge Elimination System |
| NTU | Nephelometric turbidity units |
| NUS | NUS Corporation |
| NWI | National Wetlands Inventory |
| PAHs | Polycyclic aromatic hydrocarbons |
| PCBs | Polychlorinated biphenyls |
| Pechiney | Pechiney Rolled Products, LLC |
| PID | Photoionization detector |
| PVC | Polyvinyl chloride |
| QC | Quality control |
| RAC | Ravenswood Aluminum Company |
| RAGS | Risk Assessment Guidance for Superfund |
| RBC | Risk-based Concentration |
| RCRA | Resource Conservation and Recovery Act |
| RFA | RCRA Facility Assessments |
| RFI | RCRA Facility Investigation |
| s.u. | Standard units |
| SF | Slope factors |
| SPLP | Synthetic precipitation leaching procedure |
| SRM | Standard reference materials |
| SSLs | Soil Screening Levels |
| SVOCs | Semivolatile organic compounds |
| SWMU | Solid waste management units |
| TCE | Trichloroethene |
| TCL | Target Compound List |
| TCLP | Toxicity Characteristic Leaching Procedure |
| TDS | Total dissolved solids |
| TOC | Total organic carbon |
| TOX | Total Organic Halogen |

| | |
|---|---|
| TPH | Total Petroleum Hydrocarbons |
| TPH-SRO | Total petroleum hydrocarbons - special range organics |
| TSCA | Toxic Substances Control Act |
| TSS | Total suspended solids |
| USEPA | United States Environmental Protection Agency |
| USFWS | US Fish and Wildlife Service |
| Versar | Versar, Inc. |
| VOCs | Volatile organic compounds |
| WOE | Weight of Evidence |
| WPC | Water Pollution Control |
| WV DEP | West Virginia Division of Environmental Protection |
| WV DNR | West Virginia Department of Natural Resources |

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# Executive Summary

The facility subject to this Resource Conservation and Recovery Act (RCRA) Facility Investigation encompasses 2,600 acres near Ravenswood, West Virginia, and incorporates both a reduction plant and a fabrication plant. The reduction plant produces prime aluminum from alumina ore. The fabrication plant produces plate, sheet, and coil aluminum alloy. Century Aluminum of West Virginia, Inc. (CAWV), formerly Ravenswood Aluminum Corporation (RAC), owns about 2,100 acres of the site including the aluminum reduction plant. As of September 1999, Pechiney Rolled Products, LLC (Pechiney) owns about 500 acres of the site including the fabrication plant.

Starting in 1954, Kaiser Aluminum and Chemical Company (KACC) purchased 2,600 acres of property and developed approximately 860 acres of the property as an integrated aluminum reduction and fabrication facility. RAC purchased the facility in 1989, with the exception of the Spent Potliner Pile and the Spent Potliner Vault, which were retained by KACC. The facility was renamed Century Aluminum of West Virginia, Inc. in July 1997. Pechiney purchased the fabrication plant and about 500 acres of the facility in September 1999.

A number of waste management activities have occurred at this facility. The more significant of these are spent potliner management and disposal, waste oil recovery, land treatment of oily wastewater, and landfilling. Studies have been conducted on site since the early 1970s that evaluated actual or potential effects of waste management practices on soil and groundwater. In 1980, KACC applied for RCRA interim status for a variety of waste streams and waste management units at the facility. RCRA interim status for the waste oil recovery system was transferred from KACC to RAC in 1989 in conjunction with the property acquisition. In 1994, RAC entered into a RCRA 3008(h) Consent Order to perform a RCRA Facility Investigation (RFI). The purpose of the RFI is as follows:

- To assess the nature and extent of possible releases of hazardous waste or hazardous constituents
- To obtain technical data to support a Corrective Measures Study (CMS), if one is warranted

The RFI field activities were conducted in two phases, the first initiated in 1995 and the second initiated in 1997. The 1995 RFI field activities focused on soil quality in the former potliner management areas, soil and groundwater quality in the sprayfield area, soil quality and floating oil around the oil recovery ponds, and groundwater quality at the landfills. Concurrently, KACC conducted an RFI that addressed deeper soil and groundwater quality in the vicinity of the Spent Potliner Pile, which KACC continues to own. The 1997 RFI field activities included four newly identified areas, follow-up investigations for soil in two previously investigated areas, and follow-up groundwater sampling in several areas.

A total of 18 areas were evaluated in the RFI. Field work consisted of drilling and sampling 103 soil borings, installing six monitoring wells and one piezometer, replacing one monitoring well, excavating and sampling two exploration trenches, sampling 24 new and existing monitoring wells, and testing four underground pipelines for integrity. Analyses performed on the samples varied by area and included the following: eight RCRA metals; total, weak acid dissociable, and free (by microdiffusion) cyanide; Appendix IX volatile organic compounds (VOCs) and semivolatile organic compounds (SVOCs); polychlorinated biphenyls (PCBs); oil & grease; total petroleum hydrocarbons - special range organics; Toxicity Characteristic Leaching Procedure (TCLP) metals, PCBs, and SVOCs; and synthetic precipitation leaching procedure (SPLP) metals, PCBs, and SVOCs.

The following procedure was used to evaluate soil and groundwater results. Preliminary screening was conducted to assess the completeness of the investigation, resulting in additional sampling activities in Area 5, Area 7, and Area 13. Preliminary screening consisted of comparing soil results to Conservative Preliminary Screening Levels (CPSLs) based on risk to human health and Soil Screening Levels (SSLs) based on potential migration to groundwater. In accordance with Region III policy, CPSLs were obtained from the Region III Risk-based Concentration (RBC) Table for residential soil ingestion at a Hazard Index (HI) of 0.1 or a risk level of $10^{-6}$. Metal results in soil were first compared to background concentrations to assess whether the constituent was present at greater than naturally occurring concentrations. Groundwater results were compared to West Virginia groundwater standards or federal Maximum Contaminant Levels (MCLs) when available. Groundwater screening levels were based on the Region III RBC tap water value for constituents without state groundwater standards or federal drinking water standards.

SSLs were obtained from the United States Environmental Protection Agency's (USEPA's) Soil Screening Guidance. When an SSL was exceeded in an area, indicating a potential for vertical migration of a constituent, other data for the area were evaluated to assess evidence of actual, significant vertical migration of the constituent. Other evidence included the horizontal and vertical distribution of the constituent and the presence or absence of the constituent in groundwater. In all cases where SSLs were exceeded, other evidence indicated that migration of constituents of potential concern had not occurred.

Once the investigation was deemed complete, potential effects on human health were assessed by screening the RFI results against Region III RBC Table industrial soil ingestion values, referred to in this report as generic industrial screening levels (GISLs). Future land use in the portion of the CAWV property investigated under the RFI has been determined to be industrial. For those areas with results exceeding GISLs, a site-specific risk assessment was conducted. Based on the human health risk assessment, further action is warranted to address exposure to polycyclic aromatic hydrocarbons (PAHs) "hot-spots" in Area 13 under the future industrial use scenario.

In addition to assessing potential human health effects, potential ecological effects were assessed by evaluating whether ecological settings are present at the site for which ecological screening is appropriate. The ecological setting evaluation was limited to the industrialized portion of the CAWV property in which the RFI was conducted. The ecological setting evaluation concluded that the habitats present at the site are non-sensitive and are located in non-protective areas within an operating industrial facility, and that further ecological evaluation at the facility is unwarranted.

Soil and groundwater samples collected for the RFI were evaluated to assess whether there was evidence of a release of hazardous constituents, and to evaluate whether a released constituent potentially poses a significant risk to human health and the environment. The results of the RFI are summarized below by area. A summary of the results for soil samples is also presented in Table ES-1.

### Area 1 – Old Northwest Pot Dump and Associated Areas

- Concentrations of analyzed constituents below GISLs and SSLs.
- No unacceptable risk to human health based on industrial screening.
- No further action warranted for Area 1.

### Area 2 – Potliner Loadout Area

- Analyzed metals, cyanide, and VOCs below GISLs and SSLs.
- Two PAHs exceeded their SSLs; no constituent migration anticipated from sampled material.
- One PAH exceeded its GISL.
- No unacceptable risk to human health based on risk assessment.
- No further action warranted for Area 2.

### Area 3 – Former Potliner Management Areas

- Analyzed concentrations of constituents below GISLs.
- No unacceptable risks to human health based on industrial screening.
- Two chromium results exceeded the SSL for hexavalent chromium; chromium is likely in the less mobile trivalent state.
- Total cyanide and weak acid dissociable cyanide are present in groundwater beneath Area 3. Recovery of cyanide in groundwater is accomplished by the blocking well system.
- Separate investigation of a portion of Area 3 conducted in 1998; reported separately in October 1999. The results are not included in this RFI report.
- No further action under CAWV's RFI is warranted for Area 3.

### Area 4 – Potliner Breakout and Accumulation Buildings

- Concentrations of cyanide below GISLs.
- No unacceptable risks to human health based on industrial screening.
- No further action warranted for Area 4.

### Area 5 – Former Anode Burnoff Pile, Railcar Loadout Building, and Tank Farm

*Former Anode Burnoff Pile*

- Concentrations of cyanide and metals below screening levels.
- PAHs exceeded GISLs and SSLs.
- No unacceptable risks to human health based on risk assessment.
- No significant PAH migration based on vertical concentration profile.
- No further action warranted for the Former Anode Burnoff Pile.

*Railcar Loadout Building*

- Total cyanide not detected in soil.
- No unacceptable risks to human health based on industrial screening.
- No further action warranted for the Railcar Loadout Building.

*Tank Farm*

- Concentrations of analyzed constituents below GISLs and SSLs.
- No unacceptable risks to human health based on industrial screening.
- No further action warranted for Tank Farm.

**Area 6 – Oil Recovery Ponds**

- Concentration of analyzed constituents below GISLs and SSLs.
- No unacceptable risk to human health based on industrial screening.
- Extent of oil on groundwater characterized.
- Interim measures for recovery of floating oil underway.
- No adverse impact on groundwater quality identified.
- No further action warranted for soils in Area 6.

**Area 7 – Outfall 001 Conveyance**

- Concentrations of PCBs, VOCs, and metals below GISLs.
- Cadmium, chromium, mercury, PCBs, and PAHs exceed SSLs in upper sediment samples.
- No migration of constituents based on samples of underlying soil and leachability testing of conveyance materials.
- PAHs exceed GISLs.
- No unacceptable risk to human health identified for the PAHs based on risk assessment.
- No further action warranted for Area 7.

**Area 8 – Sprayfield**

- Concentrations of analyzed constituents in soil below GISLs and SSLs.
- No unacceptable risk to human health based on industrial screening.
- No adverse impact to groundwater quality identified.
- Groundwater monitoring currently under state permit.
- No further action warranted under RCRA program.

### Area 9 – Neutralization Tank

- No residual effects identified from past releases to soil.
- No further action warranted.

### Area 11 – Tank 1

- Analyzed constituent concentrations in soil below GISLs and SSLs.
- No unacceptable risk to human health based on industrial screening.
- No further action warranted.

### Area 12 – Industrial landfill and Sprayfield Storm Water Drainage Area

- Analyzed constituent concentrations in soil below GISLs and SSLs.
- No unacceptable risk to human health based on industrial screening.
- No further action is warranted.

### Area 13 – Solid Pitch Unloading and Carbon Plant Storage Drainage Area

- Analyzed metal concentrations in soil below GISLs and SSLs.
- PAH concentrations in soil above GISLs and SSLs.
- Calculated risk for future industrial worker exceeded the less conservative end of the acceptable risk range.
- Very limited vertical migration of PAHs based on soil sampling.

### Area 14 – Subsurface Debris Area

- Benzo(a)anthracene and chromium above SSLs in debris sample.
- No migration identified of hazardous constituents from debris to surrounding soil.
- Benzo(a)pyrene present above its GISL in debris sample.
- No unacceptable human health risk based on risk assessment.
- No further action warranted.

### Old Landfill

- No release of analyzed hazardous constituents identified from the Old Landfill to the groundwater.
- No further action warranted.

### Industrial Landfill

- No release of analyzed hazardous constituents identified from the Industrial Landfill to the groundwater.
- No seeps identified around the periphery of the landfill.
- Groundwater monitoring being conducted under state permit.
- No further action warranted under RCRA program.

### Interceptor Basin 002

- No release of analyzed hazardous constituents identified from Interceptor Basin 002 to groundwater.
- No further action warranted.

### Interceptor Basin 004

- No release of analyzed hazardous constituents identified from Interceptor Basin 004 to groundwater.
- Fluoride above its groundwater screening level identified in groundwater downgradient of Interceptor Basin 004. Fluoride is not a hazardous constituent.
- No further action warranted under RCRA program.

### Site-Wide Groundwater Evaluation

- Cyanide is present in the groundwater beneath the facility.
- Cyanide in groundwater is recovered by the Blocking Well System.
- Total cyanide remains in the areas of former potliner management.
- Weak acid dissociable cyanide is present in limited areas of the site.
- Fluoride is present in groundwater at concentrations above screening levels near Interceptor Basin 004 and KACCs Potliner Pile. Fluoride is not a hazardous constituent.

### Underground Piping

- Test results were within acceptable limits.
- No further action is warranted.

## Table ES-1
## Summary of RFI Soil Investigation Conclusions

| AREA | AREA INVESTIGATED IN RFI | ANY COPC EXCEEDS CPSL | ANY COPC EXCEEDS GISL | EXCEEDS ACCEPTABLE RISK RANGE |
|---|---|---|---|---|
| 1 | Old Northwest Pot Dump and Associated Areas | Yes | No | No |
| 2 | Potliner Loadout Area | Yes | Yes | No |
| 3 | Former Potliner Management Areas | Yes | No | No |
| 4 | Potliner Accumulation and Breakout Buildings | No | No | No |
| 5a | Former Anode Burnoff Area | Yes | Yes | No |
| 5b | Railcar Loadout Building | No | No | No |
| 5c | Tank Farm | No | No | No |
| 6 | Oil Recovery Ponds | Yes | No | No |
| 7 | Outfall 001 Conveyance | Yes | Yes | No |
| 8 | Sprayfield | Yes | No | No |
| 9 | Neutralization Tank | No | No | No |
| 11 | Tank 1 | No | No | No |
| 12 | Industrial Landfill and Sprayfield Storm Water Drainage Area | Yes | No | No |
| 13 | Solid Pitch Unloading and Carbon Plant Storage Drainage Area | Yes | Yes | Yes |
| 14 | Subsurface Debris Area | Yes | Yes(1) | No |

COPC Constituent of Potential Concern
CPSL Conservative Preliminary Screening Level
GISL Generic Industrial Screening Level
(1) Exceedance was in debris sample.

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# Section 1 Introduction

The facility subject to this RFI encompasses 2,600 acres near Ravenswood, West Virginia (Figure 1-1). The facility, shown on Plate 1, incorporates both a reduction plant that produces prime aluminum from alumina ore and a fabrication plant that produces plate and coil aluminum alloy. CAWV, RAC, owns about 2,100 acres of the property, including the aluminum reduction plant. As of September 1999, Pechiney owns about 500 acres of the property, including the fabrication plant. CAWV produces molten aluminum, which is cast into ingots at Pechiney's cast house. Pechiney produces a variety of aluminum materials (plates, sheets, and coil) for the aircraft, aerospace, and defense industries. The facility is also a supplier of aluminum for the railcar, automobile, construction, lighting, truck trailer, and beverage industries.

## 1.1 Site Background

In 1954, KACC began construction of an aluminum reduction and fabrication facility located just outside of Ravenswood, West Virginia. The first fabrication and reduction operations began in 1957, and the first molten metal was cast in 1958. KACC owned and operated the facility until February 7, 1989, when ownership and operation was transferred to RAC. The facility was renamed Century Aluminum of West Virginia, Inc. in July 1997. In September 1999, CAWV sold the fabrication plant and 500 acres of land to Pechiney. KACC continues to own and maintain the Spent Potliner Pile and the Spent Potliner Vault.

The USEPA Region III and RAC entered into a RCRA Section 3008 (h) Order on Consent (Docket No. RCRA-III-069-CA) in October 1994. The Consent Order required RAC to perform an RFI for two purposes: first, to determine the nature and extent of possible releases of hazardous waste or hazardous constituents from regulated units, solid waste management units (SWMUs), and other areas at the facility; and second, to gather necessary data to support a Corrective Measures Study, if appropriate. The RFI field investigation was conducted in two phases. This RFI report summarizes the results of two RFI field investigations, integrates this information with data from previous site investigations, and provides summaries of findings for each area investigated as well as a site-wide findings summary.

In accordance with their December 1988 sales agreement, KACC revised the facility's RCRA Part A Application to transfer interim status to RAC on January 5, 1989. The facility operates under RCRA interim status, relating to closure of the original Oil Recovery System and operation of the new Oil Pond construction in the same location. CAWV transferred RCRA interim status to Pechiney in September 1999. CAWV then applied for a new USEPA identification number and currently operates as a large quantity generator (LQG). A number of other permits, including National Pollutant Discharge Elimination System (NPDES) wastewater and storm water permits, several Water Pollution Control (WPC) Permits, and air permits also regulate activities at the facility.

## 1.2 Project Objective

The objective of the RFI was to assess the nature and extent of hazardous constituents, if any, from identified areas of solid waste management at the CAWV site. Two RCRA Facility Assessments (RFAs) conducted by USEPA identified 17 SWMUs to be addressed pursuant to the 3008(h) Order on Consent. Table 1-1 summarizes these SWMUs and the other areas that have been addressed to date in the Consent Order documents. The table indicates the current owner of the property on which the SWMU or RFI investigation area is located. The final columns in the table indicate with a check whether the SWMU or other areas were determined to require no further action in the Description of Current Conditions (DCC) Report or were assessed in the RFI.

Soil samples were also collected from four background locations designated in this report as Area 10. Plate 2 illustrates the RFI soil sampling areas. Plate 3 illustrates areas where groundwater quality or oil on groundwater was investigated.

Most of the areas subject to this RFI have been investigated in the past, with interim corrective measures presently in place in Area 6 and in the areas of former potliner management. For some areas, the RFI supplements the results of past investigations. Additionally, groundwater monitoring is ongoing in the areas of former potliner management, at the Oil Ponds, at the Industrial Landfill, and at the Sprayfield. The use of available information and data to meet requirements of the RFI is consistent with Section VI of the Consent Order.

The target parameters selected for each area investigated were based on the current and past materials stored and handled in each area and on the findings of the previous investigations. Soil and groundwater samples from each area were analyzed for one or more of the following:

- RCRA Appendix IX VOCs
- RCRA Appendix IX SVOCs
- PCBs
- Total RCRA metals
- Dissolved RCRA metals
- Total Cyanide
- Weak Acid Dissociable Cyanide

- Free Cyanide by Microdiffusion
- Oil & Grease and Total Petroleum Hydrocarbons (TPH) (Special Range Organics) as indicators
- pH

Results of analyses were compared to background concentration ranges and generic industrial screening levels. Full site-specific risk assessments were conducted for areas where generic industrial screening levels were exceeded.

## 1.3 Organization of Report

This RFI Report is organized as follows:

**Executive Summary** summarizes the investigation and the evaluation of RFI results. This section also summarizes the findings of the report.

**Section 1 - Introduction** describes the CAWV site and background, along with the project objective, organization of the report, and sources of information for the report.

**Section 2 - Site Description** describes the manufacturing processes and environmental setting of the CAWV site, including regional and site geology.

**Section 3 - Project Description** describes the methods used during the RFI for both soil and groundwater investigations.

**Sections 4 through 21** detail each of the investigation areas, including results of previous investigations, the RFI sampling program, analytical results, and findings for the area.

**Section 22 - Human Health Risk Assessment** provides an evaluation of potential human health risks associated with areas where at least one constituent exceeds its screening level.

**Section 23 - References** lists the sources used for preparing this RFI report.

## 1.4 Sources

The primary sources of information for this RFI report are as follows:

- Data and observations from the 1995 through 96 and the 1997 RFI field work, including 1998 follow-up data collection.
- Previous investigations conducted by KACC, including their 1996 RFI.
- Information provided to CAWV by KACC.
- Previous site hydrogeologic investigations.

- Previous groundwater and soil monitoring results.
- RCRA Facility Assessments performed by USEPA's contractors.
- Description of Current Conditions Report.
- Site visits and visual observations.
- Aerial photographs.

A complete list of the references used in preparing this RFI report are in Section 23.

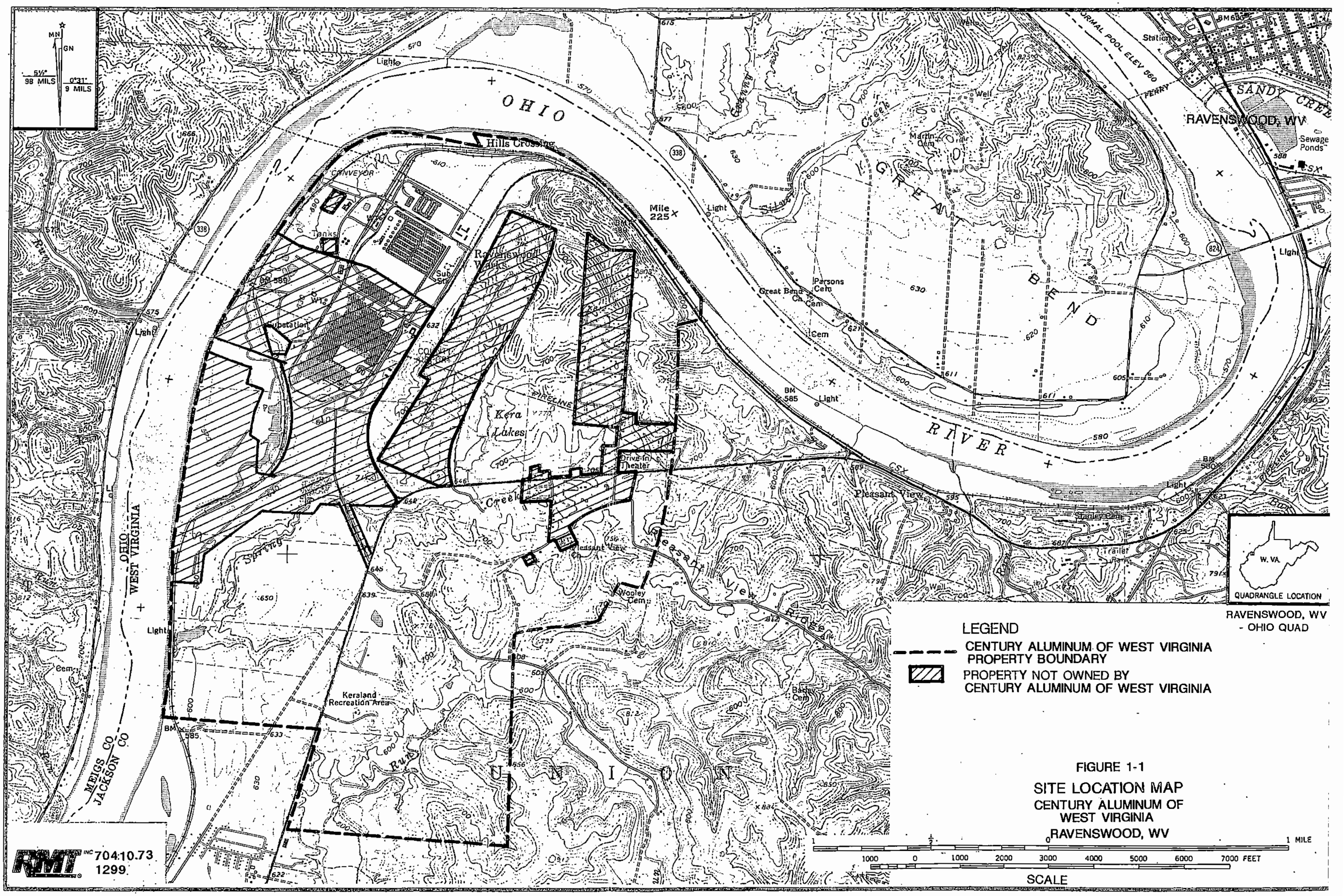

FIGURE 1-1
SITE LOCATION MAP
CENTURY ALUMINUM OF WEST VIRGINIA
RAVENSWOOD, WV

## Table 1-1
## Status of Units Addressed Per Consent Order

| NAME | OWNER | RFA SWMU NO. | RFI AREA NO. | NO FURTHER ACTION PER DCC | INVESTIGATED IN RFI |
|---|---|---|---|---|---|
| Potliner Pile (permiter and drainage) | C | SWMU 1 | Area 3 | | ✓ |
| Potliner Accumulation and Breakout Buildings | C | SWMU 2 | Area 4 | | ✓ |
| Rotary Barrel Baghouse Catch Landfill | NA (1) | SWMU 3 | | ✓ | |
| Tank 1 and Emergency Spill Basin | P | SWMU 4 | Area 11 | | ✓ |
| Oil Recovery Ponds | P | SWMU 5 | Area 6 | | ✓ |
| Tank Farm | C | SWMU 6 | Area 5 | | ✓ |
| Sprayfield | P | SWMU 7 | Area 8 | | ✓ |
| Boiler House Day Tank | C | SWMU 8 | | ✓ | |
| Elephant Shed | C | SWMU 9 | Area 3 | | ✓ |
| Siphon Aspirator Cleaning Station | C | SWMU 10 | | ✓ | |
| Horizontal Heat Quench System | P | SWMU 11 | | ✓ | |
| Neutralization Tank | P | SWMU 12 | Area 9 | | ✓ |
| Industrial Landfill | C | SWMU 13 | | | ✓ |
| Gravel Dross Landfill | C | SWMU 14 | | ✓ | |
| Sump at Pond 3 | P | SWMU 15 | | ✓ | |
| Bath Storage Pile | C | SWMU 16 | | ✓ | |
| Cooling Tower Sludge Bins | P | SWMU 17 | | ✓ | |
| Old Landfill | C | | | | ✓ |
| Old Northwest Pot Dump | C | | Area 1 | | ✓ |
| Bottomlands | C | | Area 1 | | ✓ |
| Potliner Loadout | C | | Area 2 | | ✓ |
| Anode Burnoff Pile | C | | Area 5 | | ✓ |
| Railcar Loadout Building | C | | Area 5 | | ✓ |
| 001 Outfall Conveyance | C | | Area 7 | | ✓ |

## Table 1-1
## Status of Units Addressed Per Consent Order

| NAME | OWNER | RFA SWMU NO. | RFI AREA NO. | NO FURTHER ACTION PER DCC | INVESTIGATED IN RFI |
|---|---|---|---|---|---|
| Solid Pitch Unloading and Carbon Plant Storage Drainage Area | C | | Area 13 | | ✓ |
| Subsurface Debris Area | P | | Area 14 | | ✓ |
| Interceptor Basin 002 | P | | | | ✓ |
| Interceptor Basin 004 | C | | | | ✓ |
| Underground Piping | P (2) | | | | ✓ |

Ownership: C = CAWV P = Pechiney

(1) Rotary Barrel Baghouse Catch Landfill was never constructed or used.

(2) A portion of one line that was tested crosses onto CAWV property.

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# Section 2
# Site Description

The site subject to this RFI incorporates an aluminum reduction plant and an aluminum fabrication plant located on a 2,600-acre site within Ravenswood Bottom, an alluvial deposit situated along the Ohio River. About 860 acres of the site are used for industrial purposes. In March 1998, CAWV requested a future industrial land use determination from USEPA for the industrialized portion of the site. USEPA granted the future land use determination following a public comment period.

KACC owned and operated the facility until February 7, 1989, when ownership and operation was transferred to RAC. The facility was renamed Century Aluminum of West Virginia, Inc. in July 1997. CAWV sold the fabrication plant and 500 acres of the site to Pechiney on September 20, 1999. KACC continues to own and maintain the Potliner Pile and Potliner Vault.

## 2.1 Manufacturing Operations

The facility is divided into two plants: CAWV's Reduction Plant and Pechiney's Fabrication Plant. The locations of these plants are illustrated on Plate 1. At the Reduction Plant, alumina ore is reduced to prime aluminum in the potlines. The CAWV Reduction Plant consists of four potlines, each containing 168 pots, or electrolytic cells. Molten aluminum is removed from each pot on a daily basis and transported to Pechiney's Cast House in crucibles. In the Cast House, the aluminum is alloyed and cast into ingots. Ingots are then moved from the Cast House to Pechiney's Fabrication Plant, where they are transformed into finished aluminum plate, sheet, and coil.

Alumina, also referred to as aluminum oxide ore, is transported to the CAWV facility from the Gulf Coast in barges via both the Mississippi River and Ohio River. Covered conveyors and storage silos move the alumina into the Reduction Plant. Most of the alumina is first used in the alumina scrubbers, which treat exhaust air from the potlines and carbon baking furnaces. After it is removed from the scrubbers, the reacted alumina is placed into storage silos. Next, the alumina is fed into hoppers located above each pot on the potlines.

Figure 2-1 provides a block flow diagram of operations at the facility. The following paragraphs briefly describe the various production processes at the facility in the following order:

- Potlines (owned by CAWV)
- Carbon Plant (owned by CAWV)

- Cast House (owned by Pechiney)
- Fabrication Plant (owned by Pechiney)

A discussion of plant maintenance and support follows the discussion of the primary plant processes depicted on Figure 2-1.

### 2.1.1 Potlines

CAWV operates four potlines, each consisting of 168 pots, or electrolytic cells. On each potline, two groups of 84 pots are connected in series to electricity at approximately 765 volts DC and 93,000 amperes. The pots consist of steel shells with a cathode lining composed of pre-baked carbon cathode blocks. A brick layer provides thermal insulation between the carbon cathode and the steel shell of the pot. Large steel bars embedded in the bottom portion of the cathode lining serve as cathode current collectors. These collector bars extend to openings in the shell, which are connected to the cathode bus. The anodes are blocks of carbon connected to copper rods and suspended into the pots from above. A bath of molten alumina and cryolite (sodium aluminum fluoride) separates the cathodes and anodes. The electrical current through the cryolite electrolyte promotes the following chemical reaction between the alumina and the anode:

$$2Al_2O_3 + 3C \rightarrow 4Al + 3CO_2$$

Each day, the molten metallic aluminum deposits on the cathode and is siphoned out of each pot into a crucible.

Pots eventually fail and need to be rebuilt. The removed cathode lining of a failed pot is referred to as spent potliner.

### 2.1.2 Carbon Plant

In the carbon plant, carbon anodes are produced by combining coke and pitch, pressing it into finished carbon blocks, and baking these anodes in ring furnaces. The rodding department receives the baked anodes and connects them to copper rod assemblies. The rodded anodes are suspended by the rodded assemblies from a superstructure extending over the pot so that their vertical position can be adjusted as the anodes are consumed. Anode blocks are consumed at a rate of approximately 0.5 kilogram of carbon per kilogram of aluminum produced.

### 2.1.3 Cast House

Molten aluminum from the potlines is transported to Pechiney's Cast House in crucibles. The molten metal is poured into one of ten melting furnaces where it is mixed with recyclable scrap and alloying agents. After the desired alloy is obtained, the molten metal is moved into holding furnaces. After fluxing and filtering to ensure product quality, the molten metal is poured into water-cooled molds for direct-chill casting of ingots up to 300 inches long and weighing from 5 to 25 tons. Ingots from the Cast House are transferred to the Fabrication Plant.

### 2.1.4 Fabrication Plant

Pechiney's Fabrication Plant is where cast ingots of aluminum alloy are transformed into plate, sheet, and coil, and prepared for sale to customers. After casting, the rough finish of the ingot is removed by "scalping" both wide sides in preparation for rolling. Following scalping, ingots are reheated to rolling temperatures. Heated ingots are first processed in the 168-inch hotline mill, then moved to the 110-inch hotline mill, and finally to the five-stand hotline mill. The resulting coils go to cold milling for additional processing or are sold directly to customers with cold-rolling capability.

The Hotline uses an emulsified coolant that consists of 95 percent demineralized water and 5 percent oil. The coolant is reclaimed in the Oil Reclamation Building for reuse in the hotlines. When the Hotline coolant is no longer reusable, it is pumped into Tank 1 for entry into the Oil Recovery System. This system consists of surface impoundments, an ultrafiltration system, a tank farm, an oil-fired boiler, and a sprayfield. In one of the surface impoundments, the waste coolant oil and water fractions separate. The oil fraction is skimmed from the pond and pumped to the Tank Farm. The recovered oil is then either burned in an industrial boiler or sent off site for further recovery and reuse. The water fraction is further treated in the ultrafiltration system, then the water is discharged either to the sprayfield, the constructed wetland in the sprayfield area, or the Ohio River.

The Cold Mills have neat oil coolant/lubricant systems. The coolant is recirculated from sumps beneath each mill and is periodically pumped to oil filters associated with each mill. Free flowing oil from the oil filtering media was formerly allowed to drain into the sump at Tank 1, thereby entering the Oil Recovery System. The oil is now collected separately and sent off site to a used oil reclaimer.

Finishing the aluminum at the facility is performed using two leveling lines, one for heavy gauge sheet and one for light gauge sheet. A high-speed slitter is used to cut the aluminum rolls, and an automated packing line protects coils with a polyethylene wrap that provides a moisture barrier.

Fabrication Plant processes generate aluminum scrap, which is collected and returned to the Cast House.

### 2.1.5 Plant Maintenance and Support

Machine shops and electrical maintenance shops are situated at several locations within the facility. The equipment used in the production of aluminum requires continuous preventive maintenance, including the replacement or replenishment of hydraulic oils and lubricants. Some hydraulic oils and lubricants were formerly transferred to the Tank 1 sump for processing in the Oil Recovery System. These oils and lubricants are now sent off site to a used oil reclaimer.

Both plants operate garages for maintaining and cleaning vehicles. Materials used by the garages include motor oils, transmission fluids, lubricating oils, antifreeze, and mineral spirits. Used oils and other petroleum products were formerly transferred to the Tank 1 sump where they entered the Oil Recovery System. These oils are now sent off site to a used oil reclaimer. Used mineral spirits are managed under CAWV's and Pechiney's hazardous waste programs.

The facility operates and maintains a fueling station that includes three 10,000-gallon underground tanks and associated underground piping. Two tanks contain gasoline and one contains diesel fuel. The system is equipped with an automated tank-monitoring system. In 1998, additional upgrading was conducted to maintain compliance with UST program standards.

Six other underground tanks were formerly associated with Fabrication plant cold rolling mill operations. The tanks contained non-halogenated petroleum-based products. The tanks were excavated and removed in October 1990. An investigation workplan was submitted in April 1992 to West Virginia Department of Natural Resources (WV DNR) (currently West Virginia Division of Environmental Protection (WV DEP)) and is currently being addressed by the Underground Storage Tank Division.

The facility maintains two on-site laboratories for quality control (QC) of raw materials and products. Environmental monitoring samples are sent to independent outside laboratories for analysis. From time to time, excess, off-spec, or out-of-date laboratory chemicals are sent off site to an approved facility and disposed of as hazardous waste in a lab pack. Other laboratory hazardous wastes are accumulated at a designated accumulation area within the laboratory for off-site disposal at an approved facility.

## 2.2 Waste Management Practices

The DCC Report (Malcolm Pirnie, 1995; RMT, 1996) provides a detailed description of past and current waste generation from the various operations at the facility. In the past, most wastes were treated and/or disposed of on site. Now, the only on-site waste treatment is wastewater treatment and hotline coolant oil recovery. Other wastes are sent to appropriate off-site facilities. Table 2-1 provides a review of waste generation and management at the facility.

Two landfills are located on site. The Old Landfill appears to have been used from the mid 1950s to 1960. The permitted Industrial landfill was actively used from about 1960 to 1992. Wastes formerly disposed of in the Industrial Landfill include: anode wastes and dusts from the Carbon Plant, other baghouse dusts, wet or unusable alumina, brick from furnace maintenance, demineralization resins, diatomaceous earth and solid waste from paper filters from fabrication plant coolant recycling, construction and demolition debris, used parts from vehicle maintenance, and general office and lunchroom wastes. The Old Landfill appears to have been used during plant construction and probably contains a significant amount of construction debris.

The CAWV facility has three external outfalls, of which one is permitted to receive industrial process and sanitary wastewater. The Pechiney facility has four external outfalls, of which two are permitted to receive industrial process wastewater. The sanitary wastewater from both the CAWV facility and the Pechiney facility undergoes secondary biological treatment at the CAWV facility prior to discharge from CAWV's Outfall 004. Industrial process water (Pechiney Outfalls 001, 002, and CAWV Outfall 004) flows through interceptor basins equipped with oil-skimming devices prior to discharge.

Waste hotline coolant from Pechiney's fabrication plant is recovered on site through the Oil Recovery System. Waste hotline coolant (consisting of approximately 95 percent demineralized water and 5 percent mineral oil) enters the system through Tank 1 and the sump at Tank 1. In the past, some oily wastes were deposited directly into Oil Recovery Pond 1 at its northeast corner, and some other oily wastewaters besides waste hotline coolant were managed in the Oil Recovery System. Currently, the oil is allowed to phase-separate in Oil Recovery Pond 2, then Pechiney pumps the oil to leased tanks in the CAWV Tank Farm prior to shipment to an off-site oil processor. The aqueous phase is pumped to the ultrafiltration system and then to Oil Recovery Pond 1. The treated water is discharged either in the Sprayfield, in the constructed wetlands located in the Sprayfield area, or at the 002 NPDES outfall. Formerly, the aqueous phase from the oil ponds was pumped directly to the Sprayfield for further treatment. In 1983, oil was detected in monitoring wells installed adjacent to the Oil Recovery Ponds. An oil recovery well has been installed as an interim corrective measure, which has been in operation since 1995. As of January 1999, 302.3 gallons of oil have been recovered.

Spent potliner removed from failed pots was managed on site until 1989. It is now accumulated on site in Building 66 and sent to an off-site hazardous waste landfill. Two potliner disposal units within the facility boundary, the Potliner Vault and the Potliner Pile, are owned by KACC. Past spent potliner management out-of-doors had resulted in releases of cyanide to the soil and groundwater. Six groundwater recovery wells are now used to control groundwater flow and to contain and remove the cyanide present in groundwater. Most of the groundwater recovery system, referred to as the Blocking Wells, has been in operation since the mid 1970s. Extracted groundwater is discharged to the Ohio River via CAWV's Outfall 004. Analysis of total cyanide at Outfall 004 indicates a downward trend in the concentration of cyanide since 1984.

Aluminum reduction technology has changed over the years since the Ravenswood facility was constructed in the 1950s. In December 1980, the facility changed from monolithic cathode linings where the cathode was formed and baked in place in the steel shell to prebaked cathode blocks. Prebaked cathodes are separated from the steel shell by insulating brick. This design change resulted in a decrease in cyanide concentration in spent potliner from 1 to 2 percent cyanide before 1980 to about 0.1 percent cyanide after 1980. Improvements in control technology also being implemented around 1980 significantly increased pot life. This resulted in a reduction of spent potliner production by over 50 percent.

## 2.3 Environmental Setting

The facility is located within the Ohio River Valley in Jackson County, West Virginia. The industrial property is located entirely within Ravenswood Bottom, which is a sickle-shaped bottomland alluvial deposit situated along the inside of a sharp meander (bend) of the Ohio River. The relatively flat bottomland of Ravenswood Bottom [elevation ranging from 570 feet to 630 feet above mean seal level (msl)] is bounded to the east by the valley wall that ascends to an elevation of more than 800 feet msl over a distance of less that 1 mile. These upland areas can be rugged and are characterized by steep slopes and strong relief. Stream erosion and transport, in conjunction with weathering and mass wasting of slope materials, are largely responsible for the existing topographic expression of the upland areas (Malcolm Pirnie, 1995;

RMT, 1996). Plate 1 shows topography in the plant site area. Figure 1-1 shows topography of the land surrounding the facility.

### 2.3.1 Regional Geology

The flood plain of the Ohio River consists of a deep bedrock trough filled with glacial outwash deposits, overlain in places by a surficial stratum of river alluvium. The deep bedrock trough was eroded by glacial meltwater during continental ice sheet recessions, and then filled by glacial outwash sand and gravel during the Wisconsinian Glacial Stage. Beneath the glacial deposits of the flood plain, an ancient river channel can be detected in the bedrock floor of the trough. The bedrock trough lies at an elevation of about 500 to 580 feet msl (Malcolm Pirnie, 1995; RMT, 1996).

The sand and gravel filling the bedrock channel are typical of Pleistocene glacio-fluvial deposits. The stratified coarse-grained deposits vary rapidly both vertically and laterally. The deposits range from fine sand to coarse gravel; in general, the coarser materials are found at greater depth, and in several places cobbles and boulders are found just above the top of bedrock. The top stratum consists of a layer of silts and clays that are less permeable than the coarse sand and gravel (Malcolm Pirnie, 1995; RMT, 1996).

The bedrock in the region consists of nearly flat-lying sedimentary strata, mainly shales and sandstones with a few limestone and coal beds. The rocks are assigned to the Dunkard Series in the Permian Age (Malcolm Pirnie, 1995; RMT, 1996).

### 2.3.2 Regional Hydrogeology

The glacio-fluvial deposits filling the valley trough of the Ohio River form an extensive alluvial aquifer along the length of the river valley. Based on the river-valley pattern in this area, the unconsolidated sediment may pinch-out locally, limiting the areal extent of the aquifer. An example of this includes the Ravenswood Bottom area where the bedrock valley and the Ohio River converge in the north near Hills Crossing and to the south near the mouth of Mill Creek. This isolates these areas from other sections of the Ohio River alluvial aquifer. Characteristics of the aquifer may vary locally, but the deposits are generally very permeable and the elevation of the water table is similar to that of the river surface. The alluvial aquifer has a considerable saturated thickness. As a result, the aquifer also has a very high transmissivity, which means being readily capable of transmitting water (Malcolm Pirnie, 1995; RMT, 1996).

### 2.3.3 Site Geology

Cross sections through the alluvium, prepared by Malcolm Pirnie, illustrate the overall configuration of unconsolidated deposits beneath the facility. These cross sections were presented on Plates 3 through 7 of the DCC Report, and are included in this report as Appendix A. The lithology observed in borings drilled during the RFI supported the stratigraphy illustrated by the Malcolm Pirnie cross sections. Nonetheless, USEPA expressed concern regarding cross sectional coverage in the vicinity of the Old Landfill. To address this concern, Plate 3 and Plate 6, included in Appendix A, were revised to include well MW-7, which was installed on the north side of the Old Landfill.

As illustrated in the cross sections, the unconsolidated materials underlying the facility consist predominantly of a downward-coarsening sequence of silts and clayey silts and sand and gravel outwash deposits. These unconsolidated deposits range in thickness from approximately 80 feet to 100 feet and are consistent throughout the facility. They are underlain by sedimentary bedrock (Malcolm Pirnie, 1995; RMT, 1996).

In the southern end of the site, near the Sprayfield and along the natural levee, a surficial clayey silt unit is present. This unit varies from several inches to approximately 20 feet in thickness. The surficial clayey silt unit is underlain by a thick sequence of glacially derived sand and gravel outwash deposits. The uppermost 20 feet to 40 feet of the outwash sediments are commonly dominated by 1-foot to 2-foot thick bands of medium-gravely to coarse-gravely sand, which are interlayered with silt. Where present, the contact between the predominantly sandy unit and the overlying clayey silt is commonly gradational, making exact delineation between these two units subjective (Malcolm Pirnie, 1995; RMT, 1996).

Beneath the predominantly sandy unit, at depths ranging from 40 feet to 65 feet below the land surface, are interlayered beds of sand and gravel. This sand and gravel unit is laterally continuous, rather poorly sorted, and usually contains only trace amounts (less than 5 percent) of silt. At many of the drilling locations, the sand and gravel deposits tend to become more coarse-grained with depth, with an overall increase in the relative abundance of gravel (Malcolm Pirnie, 1995).

Immediately underlying the unconsolidated deposits are sedimentary rocks. Primarily of near-shore deltaic origin, this cyclothermic assemblage consists mainly of interbedded shales, siltstones, and sandstones, with some limestone and coal beds (Malcolm Pirnie, 1995; RMT, 1996).

### 2.3.4 Site Hydrogeology

The uppermost aquifer unit beneath the facility is the alluvial aquifer, which is present beneath the entire site. Deposits within this aquifer consist primarily of sand and gravel outwash, which were laid-down during Pleistocene glaciation events. Groundwater within the alluvial aquifer exists under water-table conditions beneath much of the plant site; at depths ranging from about 40 feet to 70 feet below ground surface. The base of the alluvial aquifer system occurs at the alluvium/bedrock contact. The buried bedrock surface slopes from the valley wall toward the Ohio River, reflecting the U-shaped configuration of the bedrock valley prior to aggradation (infilling) by the glacial outwash (Malcolm Pirnie, 1995; RMT, 1996).

The alluvial aquifer is quite prolific and is capable of pumping at a sustained rate of a million-gallons-per-day. Under normal river stage and non-pumping conditions, the alluvial aquifer is recharged by infiltrating precipitation and by discharges from bedrock strata buried adjacent to and beneath the alluvium (Malcolm Pirnie, 1995).

In the early 1970s, the level of the river was raised about 16 feet, increasing the normal pool elevation from 544 feet to 560 feet msl. The rise in river level resulted in a similar rise in aquifer water level. Because of this rise in water level in the unconsolidated material, the aquifer thickness is now about 40 feet to 50 feet. This rise in water level has increased the aquifer's capability for transmitting water (Malcolm Pirnie, 1995; RMT, 1996).

#### *Groundwater Flow Direction*

In the late 1960s KACC developed a "blocking well" system to control the migration of cyanides in the aquifer. The blocking well system began with the pumping of groundwater from two production wells (R3 and F3). Additional wells were added to the pumping system over time. CAWV continues to operate the blocking well system, which currently consists of wells R-1, R-2, R-3, R-4, F-1, and F-10 (which replaced F-3). These wells are reported to be pumped at a combined average rate of about 1,200 to 1,300 gallons per minute (gpm), or about 1.7 to 1.8 million gallons per day (mgd).

Pechiney operates two wells, F-8 and F-9, on the south end of the facility, where groundwater is unaffected by site activities. These wells can be operated together or on an alternating basis to supply both the CAWV and Pechiney plants with production and potable water. The average flow from well F-8 is about 1.2 mgd to 1.3 mgd; the average flow from well F-9 is about 1.4 mgd to

1.5 mgd. Typically, F-8 is run continuously and F-9 is used as needed to meet the facility's water demand.

Pumping of groundwater from the blocking wells and production wells has altered the natural direction of groundwater flow. Under non-pumping conditions, groundwater flow is from the valley wall towards the Ohio River. Pumping of groundwater from the blocking wells and production wells results in groundwater flow from the valley wall and the Ohio River toward the pumping wells.

Two rounds of water level measurements were collected during the RFI from observation wells, monitoring wells, and piezometers located site wide. Round 1 measurements were collected on January 18, 1996 (Table 2-2). Round 2 measurements were collected on August 28, 1997 (Table 2-3). Some of the wells had been damaged and repaired between the January 1996 and August 1997 monitoring dates, thus changing their top-of-casing elevations. In September 1997, the elevations of all on-site observation wells, monitoring wells, and piezometers were resurveyed. Except for the wells that had been repaired, most well elevations remained the same or displayed minor elevation variations. Because it is unclear which wells had been repaired, water level measurements collected in January 1996 are referenced to the old top-of-casing elevations and water level measurement collected in August 1997 are referenced to the new top-of-casing elevations. All future measurements should also be referenced to the new top-of-casing elevations.

Plates 4 and 5 illustrate groundwater elevations and flow direction for groundwater in the upper silt and clay deposits and the lower sand and gravel deposits in January 1996 and August 1997, respectively. Groundwater in the northern and central areas of the facility flows toward the blocking wells, while groundwater in the southern section of the site flows toward the production wells. Operation of the Sprayfield and seasonal ponding of the surface runoff from adjacent areas of the site has produced groundwater mounding in the clayey silt unit beneath the sprayfield. Except for this area of mounded groundwater, groundwater flow across the site is from the Ohio River and the valley walls toward the pumping wells. Operation of the Sprayfield area has changed since the RFI was conducted, as discussed in Section 11.

*Groundwater Flow Velocity*

The hydraulic properties of the lower portion of the sand and gravel aquifer have been determined through an evaluation of existing pumping test records from fabrication well F-7, which is situated adjacent to Pond 1 and screened across the lower portion of the alluvial aquifer. Data from a pumping test conducted in 1968 have been analyzed using Jacob's equation for a non-leaky artesian unconfined aquifer, with corrections to reflect water-table conditions. The pumping test drawdown data indicated that the transmissivity (T) of the lower portions of the aquifer in the area of F-7 is about 400,000 gpd/ft. Based upon an estimated aquifer saturated thickness of 40 feet, this T corresponds to a hydraulic conductivity (K) of 0.472 cm/sec (Malcolm Pirnie, 1995, RMT, 1996). Based on groundwater levels, the average hydraulic gradient in the sand/gravel aquifer is approximately 0.001 ft/ft. Using these hydraulic conductivity and hydraulic gradient values, the groundwater flow velocity in the sand/gravel aquifer can be approximated using the following equation:

$$V = KI/n \times 1.03 \times 10^6$$

where,

| | | |
|---|---|---|
| V | = | velocity (ft/yr) |
| K | = | average hydraulic conductivity (cm/sec) |
| I | = | average hydraulic gradient (ft/ft) |
| n | = | assumed effective porosity (assumed to be 0.25 for predominantly sand and gravel deposits) |
| $1.03 \times 10^6$ | = | conversion factor from cm/sec to ft/yr |

Groundwater flow velocity at the site, based on January 1996 and August 1997 average hydraulic gradients and the results of the F-7 pumping test, is approximately 1,900 ft/yr.

## 2.4 Land Use and Potential Human Receptors

Figure 2-2 illustrates the various uses of the land surrounding the facility. The nearest residences are located in the hills approximately ¾ mile east of industrial operations. These residences are served either by a public water supply or by pumping groundwater from an aquifer that does not underlie the facility. The nearest residences to the south of the facility are in the community of Millwood, about 1½ miles south of the closed on-site industrial landfill. These residences get their water from the Cottageville Public Water Supply System. The Jackson County Industrial Park is located along the southwest corner of the facility property and also obtains its water from the Cottageville Public Water Supply System. The City of Ravenswood is more than 3 miles upriver (5 miles by road) of the facility. Point Pleasant, the nearest major downstream community, is more than 25 miles down river from the facility. Both of these communities, as well as a number of other smaller communities located between the facility and Point Pleasant, are hydraulically isolated from the facility. The City of Huntington, West Virginia (located approximately 70 miles downriver from the facility), is the nearest down river public water supply intake from the Ohio River.

CAWV and Pechiney are active industrial facilities and are expected to remain that way for the foreseeable future. In correspondence dated March 5, 1998, CAWV submitted documentation consistent with USEPA guidance contained in OSWER Directive 9355.7-04 (USEPA, May 25, 1995) titled *Land Use in the CERCLA Remedy Selection Process*, that supported a determination of future industrial land use for the active portion of the facility. Following a public comment period, USEPA agreed to future industrial land use for the RFI and subsequent reports and actions. Correspondence from USEPA granting the future land use determination is included in Appendix M. Figure 2-3 shows the future industrial land use area.

## 2.5 Ecological Setting

The ecological setting evaluation of the facility focused on approximately 860-acres of the site that was determined to have future industrial land use. An Ecological Setting Report was submitted to USEPA in April 1999 (RMT, 1999). This section of the RFI Report presents the information provided in the separate report plus additional information provided to USEPA in response to their review comments. Habitats identified in the industrial areas of the CAWV and Pechiney properties are exposed to various amounts of typical manufacturing activities, some areas having only limited impact from routine industrial activities and many areas having frequent physical disturbances, such as mowing and traffic. Industrial areas having limited disturbance now may, in the future, become more actively and frequently disturbed.

Preparation of the ecological setting description consisted of identifying habitats at the site through a literature review and an on-site evaluation. Habitats at the site were then compared to the list of sensitive environments presented in USEPA's *Ecological Risk Assessment Guidance* (1994). Potential receptors inhabiting these areas were also identified.

### 2.5.1 Literature Review

The ecological setting evaluation included reviewing literature to define the ecological region in which the project site is located. Various state and federal agencies were contacted to identify sensitive ecological resources (both plants and animals) within their jurisdiction. Copies of the correspondence are included in Appendix M of this RFI report. Information obtained from the literature review is presented below.

### *Biological Setting*

**Flora:** The facility is generally located within the Western Hill Section - Central Hardwood Forests of West Virginia. The Central Hardwood Forest covers a highly dissected plateau that contains many topographical conditions that strongly influence local forest cover. Ridgetops and the xeric south and southwest slopes support a forest of oak-pine and oak-hickory. North-facing slopes and deep, fertile coves support the mixed, mesophytic or cove hardwoods (Core, 1966). The facility is specifically located within the Ohio River Lowland Natural Region of West Virginia (personal communication with Barbara Sargent, West Virginia Division of Natural Resources, December 1998). The Ohio River Lowland lies along the western boundary of West Virginia, which is mostly an area of rolling hills with broad, fertile river bottomlands. The facility is located in the vicinity of the Ohio River Islands National Wildlife Refuge, which consists of 19 islands (15 in West Virginia) located along 363 miles of the Ohio River from Pennsylvania to Kentucky. The nearest of these islands to the facility are located approximately 7 river miles upstream and 6.3 river miles downstream. The plant communities of the NWR, as described by Tolin and Schetting (1983), are analogous to those found at the facility. A more detailed description of the facility-related plant communities is contained in the results of the on-site investigation.

**Fauna:** The southern and northern faunal elements of West Virginia intermingle in the Central Hardwoods Forest and the oak-pine forests of the ridge and valley section (Core, 1966). According to the US Fish and Wildlife Service (USFWS) (1996), 160 species of birds occur in the Ohio River Islands NWR. More than 160 species of birds, including 48 waterfowl, 14 raptor, and 100 songbird species occur in the refuge. The most common mammals in the refuge include beaver (*Castor canadensis*), cottontail rabbit (*Sylvilagus floridanus*), mink (*Mustela vison*), muskrat (*Ondatra zibethicus*), opossum (*Didelphis marsupialis*), raccoon (*Procyon lotor*), woodchuck (*Marmoto monax*), and white-tailed deer (*Odocoileus virginianus*) (Tolin and Schettig, 1983).

Tolin and Schettig (1983) report a low diversity of amphibians and reptiles in the Ohio River Islands NWR. Appropriate habitat for amphibians and reptiles include embayments and unconsolidated shorelines. In the project area, most of the shoreline is steep or consolidated. Portions of the northern edge of the site may provide suitable amphibian and reptile habitat. Amphibian species observed by Tolin and Schettig (1983) include the American toad (*Bufo americanus*), and several frog species (*Rana spp.*). Reptile species observed by

Tolin and Schettig (1983) include the snapping turtle (*Chelydra serpentina*), the eastern spiny soft shell turtle (*Trionyx spiniferus spiniferus*), and the ill-tempered northern water snake (*Natrix sipedon sipedon*).

Dr. Thomas Pauley of Marshall University was also contacted regarding potential reptiles and amphibians in the project area. Dr. Pauley stated that the project area was within the ranges of several reptiles and amphibians; however, they would be present only if suitable habitat were available, such as embayments along the Ohio River or wetlands. There are no embayments or suitable wetland habitats along the shoreline of the project area.

#### *Rare, Threatened, or Endangered Species*

According to the USFWS, except for occasional transient species such as the bald eagle (*Haliaeetus leucocephalus*), no federally listed threatened or endangered species, or species of concern are known to exist in the project area (Appendix M).

The WV DNR also provided written comments about the site, which are included in Appendix M. WV DNR reported that they had no known records of rare, threatened, or endangered species within the project area.

#### *State and National Parks, Wilderness Areas, Wildlife Refuges*

No state parks, national parks, or wilderness areas were located within a 5-mile radius of the facility. As previously mentioned, Letart Island is the nearest island downstream of the project area located in the Ohio River Islands NWR system. Buffington Island, the nearest island upstream of the project in the Ohio River Islands NWR system, is located approximately 7 miles upstream.

### 2.5.2 On-site Evaluation

The on-site evaluation of the facility was conducted on December 15 and 16, 1998. The on-site evaluation consisted of observing the project area within the facility to identify sensitive habitats and potential plant or animal ecological receptors within those areas of the CAWV and Pechiney properties potentially affected by facility-related activities. Those specific areas of the facility that underwent the habitat evaluation were approved by USEPA prior to commencement of the on-site evaluation and are identified in Figure 2-3. Photographs were taken of plant communities and animals observed during the on-site inspection. Selected photographs are provided in Appendix M of this RFI report.

Plant and animal communities observed during the on-site survey were recorded. Facility personnel were also interviewed to corroborate information obtained during the literature review and the on-site survey. Habitats observed at the site were compared to a list of sensitive environments (including, but not limited to, threatened and endangered species, state or national parks, wildlife refuges, wilderness areas, fish and shellfish spawning areas, and migratory pathways and feeding areas were evaluated) presented in Table 1-1 of *Ecological Risk Assessment Guidance* (USEPA, 1994).

Approximately 860 acres of the entire 2,600-acre facility were included in this ecological setting evaluation. Of this 860 acres, approximately 376 acres consist of industrial facilities such as buildings, roads, railroad tracks and sidings, parking lots, tank farms, surface impoundments, and storage and disposal areas. RFI Areas 4, 5, 9, 11, and portions of Area 3 are located within the industrial facilities. RFI Areas 7, 8, 12, and portions of Area 6 are permitted wastewater treatment or discharge units. The remaining area of the site consists of grassy areas (440 acres), the majority of which were mowed, and woodlands (44 acres). These areas are delineated on Plate 6. A description of each of these ecological settings follows.

### *Grassy Areas*

Grassy areas are located in the northern, western, southeastern, and southwestern sections of the project site, and in the closed industrial landfill area. Grassy areas in the western and southeastern sections and the closed landfill area are well maintained, mowed areas (see Photograph 1, Appendix M). The following RFI Areas were located in these mowed areas: Areas 6, 14, and 13; the majority of Areas 1 and 3; and a portion of Area 2. Except for a portion of Areas 3 and 13 and the closed industrial landfill area, these areas are enclosed by a 6-foot fence topped with three strands of barbed wire. Access for animal migration through these areas is therefore limited to a great extent.

Grassy areas in the southwestern section of the project site, in the vicinity of the spray irrigation fields, appear to meet the definition of early oldfield, which consists of 90 percent or more of herbaceous species, including grasses, forbs, creepers, climbers, parasites, and composites (Tolin and Schettig, 1983). During winter months, dead vegetation in early oldfield areas usually forms thick mats, which was the case during the on-site investigation. All of Area 8 (except the flooded portion of the spray irrigation fields) was located in early oldfield habitat (see Photograph 2). However, the spray irrigation fields are wastewater treatment and disposal units operating in accordance with an NPDES permit and a West Virginia waste disposal permit.

### *Woodlands*

The largest woodland area is located on the northern edge of the site between the railroad tracks and the Ohio River (see Photograph 3). This area consists of two terraces along approximately 3,700 feet of the Ohio River: the first bottom terrace adjacent to the river ranges from 30 yards to 50 yards in width; and the second bottom terrace is approximately 10 feet higher in elevation and approximately 50 yards wide. A cleared area with a dirt road was located between the second terrace and the railroad tracks (see Photograph 4).

Tree species observed in these woodlands included black willow (*Salix nigra*), cottonwood (*Populus deltoides*), black walnut (*Juglans nigra*), hackberry (*Celtis occidentalis*), sycamore (*Platanus occidentalis*), wild black cherry (*Prunus serotina*), silver maple (*Acer saccharinum*), and boxelder (*Acer negundo*). The dominant species in this area are sycamore, boxelder, black walnut, and silver maple. The canopy cover in both areas is approximately 75 percent. There are a few sycamores in this area that have a diameter at breast height of approximately 4 feet, and are approximately 120 feet high. Identifiable vegetation in the understory includes, grape vines (*Vitus riparia*), Japanese knotweed (*Polygonum cuspidatum*), Rambler rose (*Rosa multiflora*), tall ironweed (*Vernonia altissima*), and sedges (*Carex* spp.).

Other wooded areas are located along and adjacent to the Ohio River in the rest of the facility. The width of this wooded riparian area ranges from 40 feet to 60 feet. The top of the riverbank is approximately 20 feet to 50 feet higher than the river surface, with a bank slope ranging from 30 degrees to 40 degrees. These wooded areas include sections of Areas 1, 2, and 3 adjacent to the Ohio River (see Photograph 5). In some places, particularly near the barge dock, the riverbank is stabilized with riprap (see Photograph 6). Tree species observed along the river included boxelder, black locust (*Robinia pseudo-acacia*), and silver maple. Plant personnel stated that some of the trees (poplar species) were planted for bank stabilization.

A line of trees was also observed along the NPDES Outfall 001 discharge conveyance. This area is not a natural wildlife area, as it is associated with an engineered structure constructed for the specific purpose of conveying an NPDES discharge. The length of this area is approximately 1,500 feet and the width is approximately 150 feet. This location corresponds to Area 7. Dominant tree species in this area include cottonwood, silver maple, and sycamore. Almost no understory is present in this area (see Photograph 7 and Photograph 8).

### *Wetlands*

The USFWS National Wetlands Inventory (NWI) map for Ravenswood, West Virginia - Ohio identifies several potential wetlands within the project area. The NWI map was prepared in 1990 based on an aerial photograph taken in 1984. The map was based on photo-interpretation, and no ground proofing was conducted. Site "wetlands" identified on the inventory map as temporarily or permanently flooded are not natural wetlands, but are instead man-made surface impoundments in industrial use for wastewater management. Of the potential wetlands identified on the NWI map within the project area, only the northernmost is not man-made. The northernmost indicated potential wetland is located within the woodland described above. It is part of the first bottom terrace along the Ohio River. During the site visit, the location that was indicated on the wetland map was not distinguishable from the surrounding hardwood forest.

### *Animals*

According to plant personnel, various mammals observed at the facility include white-tailed deer, woodchucks, skunks (*Mephitus mephitus*), red foxes (*Vulpes fulva*) and gray foxes (*Urocyon cinereoargenteus*), raccoons, rabbits, opossum, and small rodents. Common bird species observed include turkey vultures (*Cathartes aura*), great blue herons (*Ardea herodias*), starlings (*Sturnus vulgaris*), pigeons (*Columba livia*), cardinals (*Cardinalis cardinalis*), crows (*Corvus brachyrhynchos*), turkeys (*Meleagris gallopavo*), Canada geese (*Branta canadensis*), kestrels (*Falco sparverius*), chickadees (*Parus* spp.), and various duck species. Ospreys (*Pandion haliaetus*) are occasionally observed in the spring.

During the on-site investigation, the most commonly observed animals were white-tailed deer and woodchucks, which were seen throughout the grassy areas of the site (see Photograph 9). White-tailed deer were also observed in the wooded area along the discharge conveyance to the NPDES Outfall 001. Plant personnel stated that wild turkey can also be found in this area. A Cooper's hawk (*Accipter cooperii*) was observed near the fabrication plant feeding on a pigeon (see Photograph 10). Many of the previously listed birds were observed during the on-site survey, as well as some unidentified ducks in the spray irrigation constructed wetland.

### 2.5.3 Ecological Characterization

The 860-acre study area included current industrial process areas (376 acres), grassy areas (440 acres), and wooded areas (44 acres). No sensitive habitats, as described in Table 1-1 of *Ecological Risk Assessment Guidance* (USEPA, 1994), or sensitive environments (including threatened or endangered species habitat, wetlands or national or state wildlife refuges or parks) were found within the immediate area of the facility. The less disturbed areas, which represent the higher quality habitat in the study area, include the riparian woodlands north of Area 13 and the oldfield grasslands adjacent to the spray irrigation ponds in Area 8. However, the grassy areas outside the facility fence (portions of Areas 3 and 13) and wooded portions of Areas 1, 2, and 3 adjacent to the Ohio River do serve as wildlife habitat for a number of species, particularly woodchucks and white-tailed deer.

Information obtained from Federal and State authorities indicate that there are no known threatened, endangered, or rare species, or sensitive habitats within the immediate vicinity of the facility-related activities. An on-site investigation identified the habitats present at the facility as being composed largely of grassy areas with a small proportion of woodlands. Large portions of these grassy areas are mowed on a regular basis and some are located within the facility fence in areas used in the manufacturing processes being conducted at the facility. The alteration of the environment resulting from the routine landscaping program and the activities associated with the manufacturing processes, in addition to the fence, are likely to limit the use of the areas by potential ecological receptors.

The highest quality habitats at the facility are limited to the grassy areas or woodlands within the following RFI areas: woodlands along the Ohio River from Area 3 upstream to the facility property boundary and grassy areas outside the facility fence in Area 3 and Area 13.

These habitats are designated as being non-sensitive and are located in non-protective areas within an operating industrial facility. As such, they are subject to potential significant alteration, including removal, as part of any future expansions of the facility.

Alteration or removal of these habitats would not adversely impact the populations of ecological receptors that have been sighted traversing the facility. The predominant terrestrial mammalian species observed at the facility, deer and wood chuck, are known nuisance species and can be harvested with permission from the State of West Virginia based solely on this status. Consideration of these facts leads to the conclusion that further ecological evaluation of the facility is unwarranted.

### 2.5.4 USEPA Preliminary Ecological Risk Screening

In response to the Ecological Setting Report submitted to USEPA by CAWV in April 1999, USEPA prepared a preliminary Ecological Risk Screening Assessment dated August 10, 1999. A copy of this report and a copy of CAWV's response to USEPA's report are included in Appendix M.

USEPA's assessment concluded that two areas of the site may be of concern based on the ecological screening evaluation. These areas are the 001 Outfall Conveyance and the south end of the Sprayfield. The 001 Outfall Conveyance is of concern to the USEPA ecological risk assessor because of the potential for solids in the conveyance to migrate to the Ohio River. CAWV has addressed this issue by sampling sediments in the Ohio River at the 001 Outfall and by providing information and calculations demonstrating that solids in the outfall do not have the potential to adversely affect the Ohio River. The Ohio River sediment sampling results, which were within the typical range for the Ohio River, are discussed in Subsection 10.2 of this RFI report.

Sample SB-806 (0 feet to 0.5 feet), which is located in a portion of the sprayfield that is not currently used for wastewater treatment, had arsenic, chromium, and lead concentrations above preliminary screening levels for the Short-tailed Shrew and the American Woodcock. The shrew and woodcock were selected by USEPA as examples of animals that might inhabit an early oldfield habitat and were not based on observation at the site. While the area in the vicinity of SB-806 is not currently in use for wastewater treatment, it is still available for that purpose. The southern portion of the sprayfield area continues to be routinely mowed and maintained for potential wastewater treatment use. Thus, the early oldfield habitat is near SB-806, but does not include that location. A dietary exposure model was used to further evaluate potential environmental effects to a shrew and woodcock residing in the vicinity of SB-806. The analysis is provided in the correspondence included in Appendix M. The results were ecological effects hazard quotients below the comparison level of 1 and therefore within the acceptable risk range.

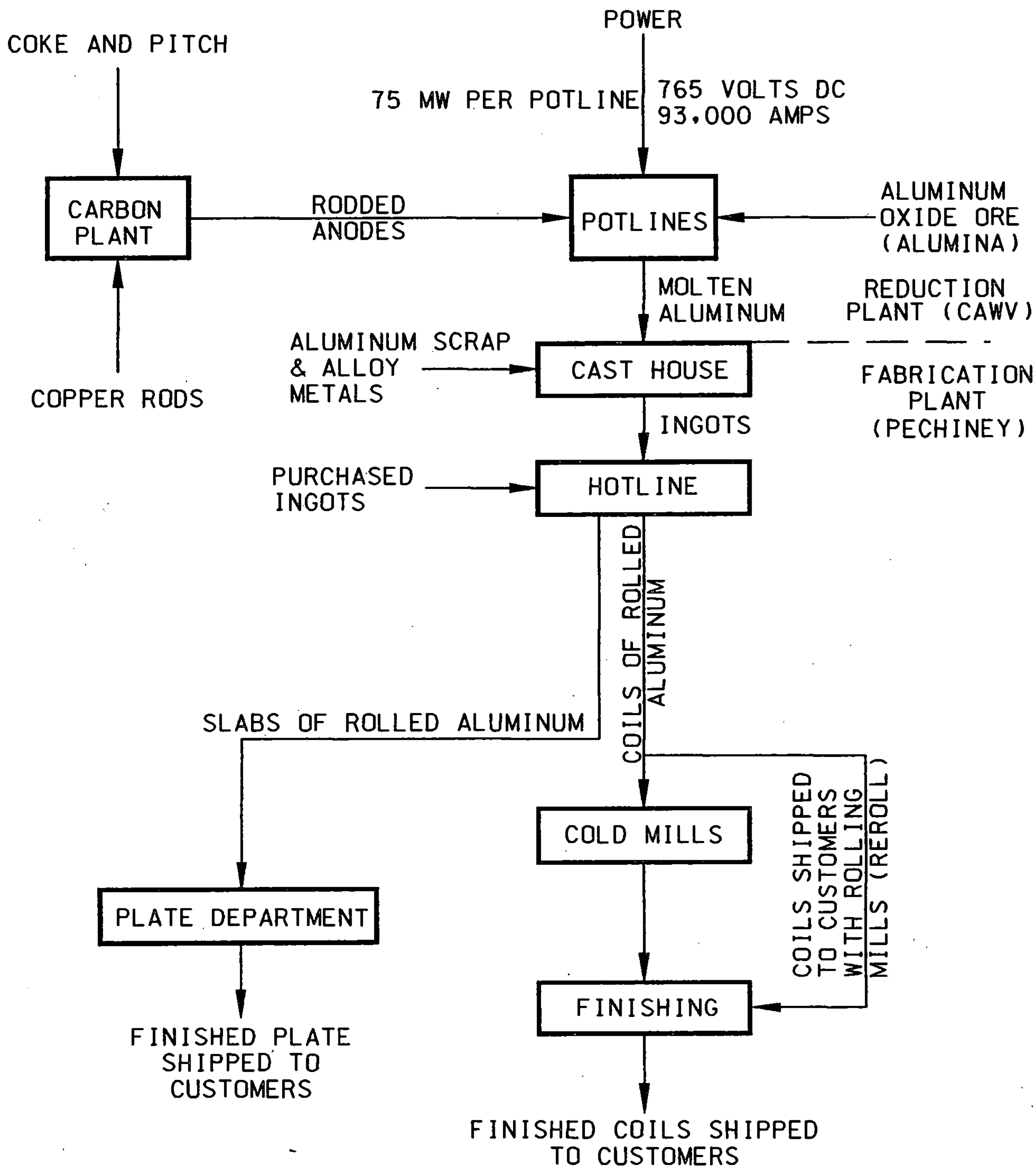
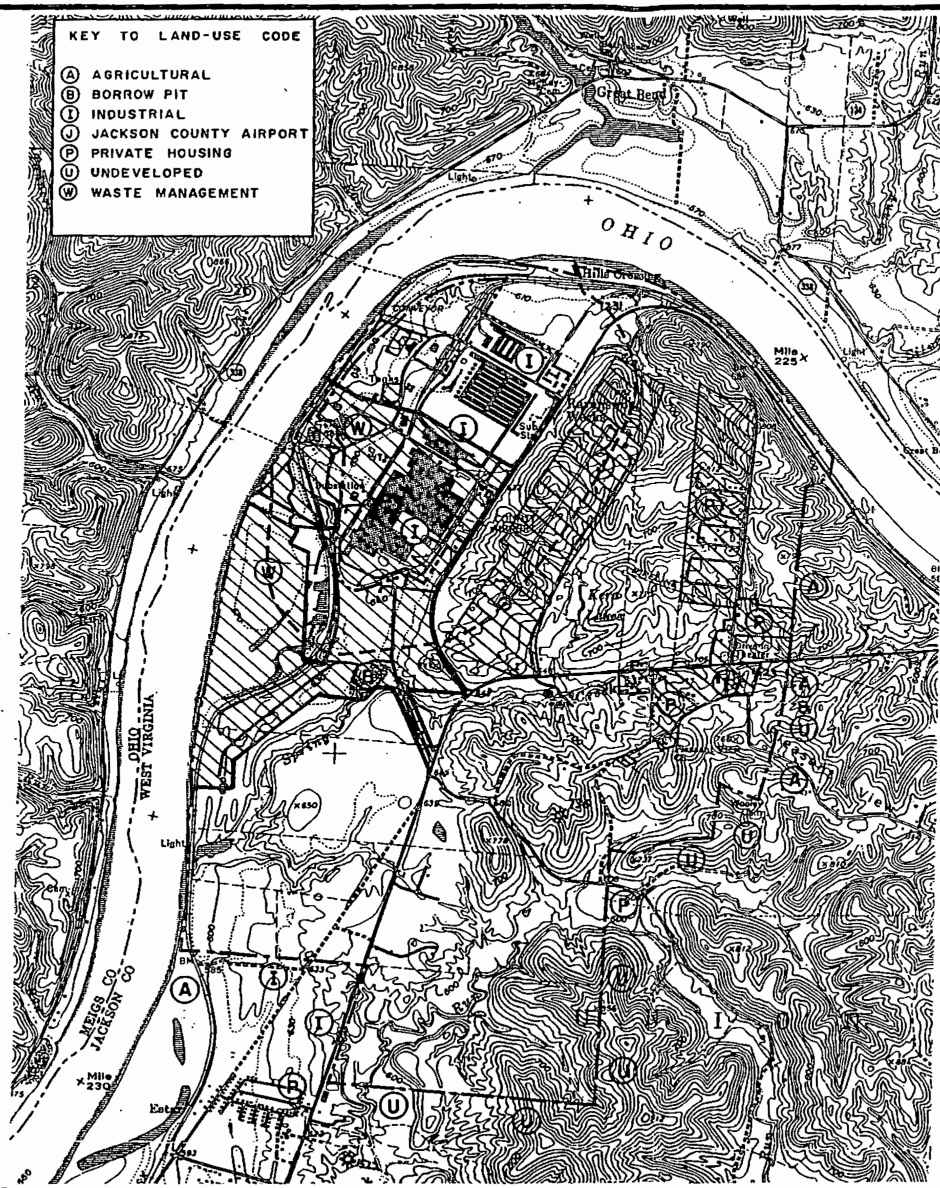


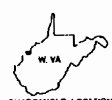

FIGURE 2-1

BLOCK DIAGRAM OF ALUMINUM MANUFACTURING PROCESS

70410.73
1299

CENTURY ALUMINUM OF WEST VIRGINIA
RAVENSWOOD, WV



QUADRANGLE LOCATION

1960
PHOTOREVISED 1987
DMA 4661 IV NE-SERIES V854

SCALE

0 2000 Feet

CONTOUR INTERVAL 20 FEET

LEGEND

(R) LAND-USE CODE (SEE KEY)

PROPERTY NOT OWNED BY CENTURY ALUMINUM

PROPERTY BOUNDARY CENTURY ALUMINUM OF WEST VIRGINIA

INDUSTRIAL PLANT FENCE LINE

1/4 MILE DISTANCE FROM PLANT FENCE

(Source: Ravenswood, W. VA.-OHIO 7.5' U.S.G.S. Quadrangle)

NOTE:
THIS MAP WAS PREPARED BY GERAGHTY & MILLER, INC. DATED 1/15/91

REVISED BY RMT DECEMBER 1999

FIGURE 2-2

**LAND USE SURROUNDING FACILITY**
CENTURY ALUMINUM OF
WEST VIRGINIA
RAVENSWOOD, WV

RMT INC 70410.73
1299

THE PRINT MACHINE, INC. N03478

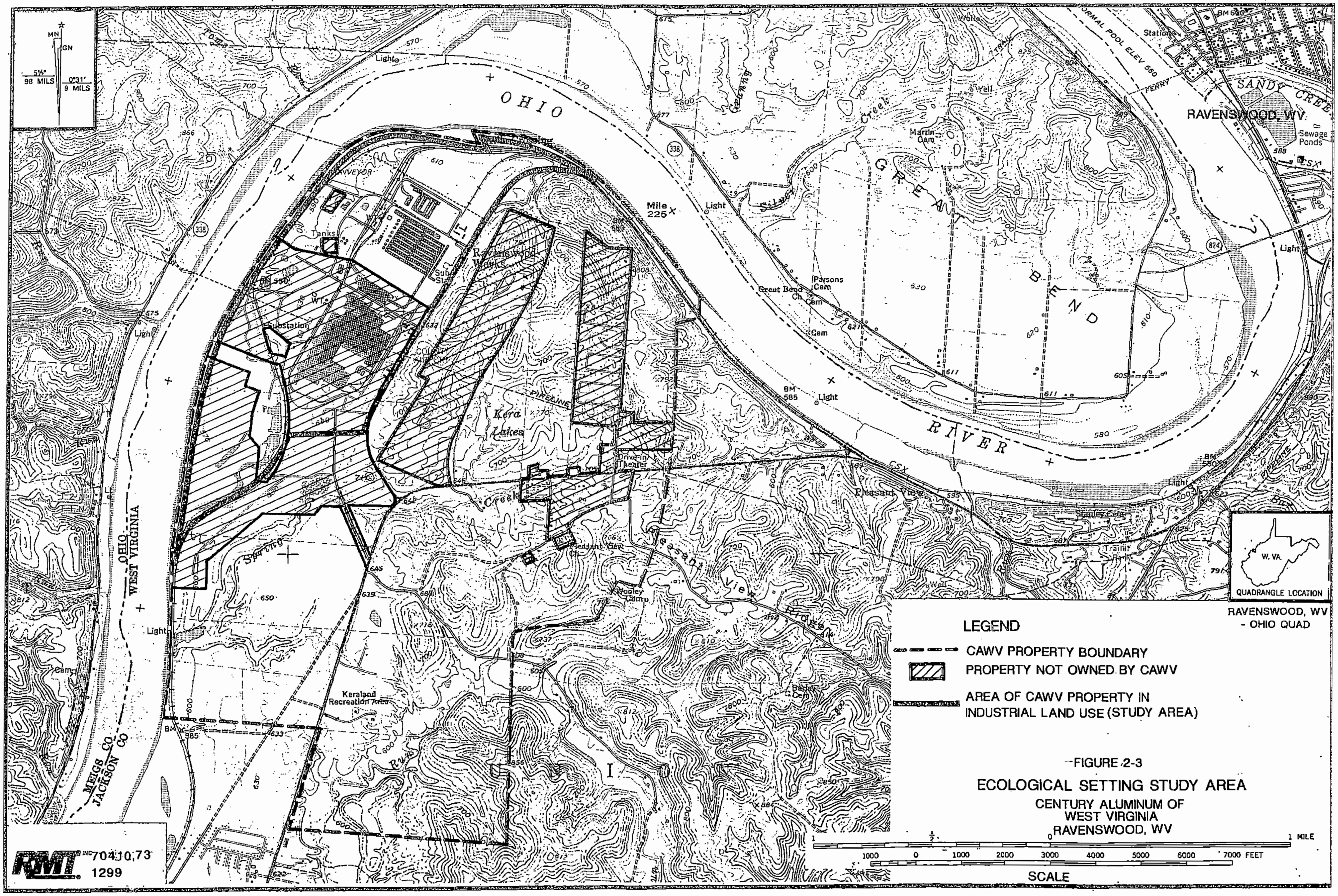



FIGURE 2-3
ECOLOGICAL SETTING STUDY AREA
CENTURY ALUMINUM OF WEST VIRGINIA
RAVENSWOOD, WV

THE PRINT MACHINE, INC. N03478

**Table 2-1**
**Review of Waste Generation and Management**

| PLANT AREA (end product) | RAW MATERIALS | WASTES GENERATED | KNOWN PAST MANAGEMENT | CURRENT MANAGEMENT |
|---|---|---|---|---|
| **Reduction Plant** | | | | |
| **Carbon Plant (rodded anode assemblies)** | Delayed Coke, Fluid Coke, Liquid and Solid Pitch, Recycled Carbon, LCOR Solvent | Scrap Anodes, Baghouse Dust, and Carbon Dust | Recycled On-site, or On-site Landfill (1) | Recycled On-site, or Off-site Solid Waste Landfill |
| | Refractory Brick, and Concrete | Waste Brick, and Debris | On-site Landfill (1), or Fill | Off-site Solid Waste Landfill (Flue Brick use On-site As Roadbase) |
| | Rods, Gussets, and Thimbles | Scrap | Scrap Recycler, or Materials Exchange | Scrap Recycler, or Materials Exchange |
| | Pig Iron, and Alloying Metals | Arc Furnace Dross, Baghouse Dust | On-site Landfill (1) | Off-site Solid Waste Landfill |
| **Potrooms and Scrubbers (molten prime aluminum)** | Rodded Anodes | Butts and Burnoffs | Recycled On-site, or On-site Landfill (1) | Recycled On-site, or Off-site Solid Waste Landfill |
| | Virgin Alumina and Scrubber Alumina, Scrubber Bags and Filters | Wet or Contaminated Alumina, Scrubber Bags and Filters | On-site Landfill (1) | Off-site Solid Waste Landfill |
| | Cryolite Bath and Fluoride | Gaseous Fluoride | Air Emissions | Captured in Scrubber and Recycled into Pots |
| | | Spent Bath and Dust | Recycled | Recycled, Sold, or Off-site Solid Waste Landfill |
| | | Particulate Fluoride | Air Emissions | Landfilled with Scrubber Bags and Filters |

Table 2-1
Review of Waste Generation and Management

| PLANT AREA (end product) | RAW MATERIALS | WASTES GENERATED | KNOWN PAST MANAGEMENT | CURRENT MANAGEMENT |
|---|---|---|---|---|
| **Reduction Plant (continued)** | | | | |
| **Pot Repair (rebuilt pots)** | Cathode Paste (old monolithic pots), Insulator Brick, Prebake Cathodes, Collector Bars, Cold Paste (Coal, Liquid Pitch), Silica-Carbide Brick | Collector Bars | Scrap Recycler | Scrap Recycler |
| | | Spent Potliner and Brick | Shipment Off-site and Brick On-site Accumulation | Off-site Hazardous Waste Landfill, or Off-site Thermal Treatment |
| **Rectifier Station (electric power)** | Electric Power, Transformer Oil | Non-PCB Waste Oil | Oil Recycler | Oil Recycler |
| | | Waste Oil with PCBs | Off-site Disposal as Appropriate for PCB Content | Off-site Disposal as Appropriate for PCB Content |
| **Fabrication Plant** | | | | |
| **Cast House (ingots of various aluminum alloys)** | Prime Aluminum, Scrap Aluminum, Alloying Metals | Induction Furnace and Dross Chiller Baghouse Dusts | On-site Landfill (1) (No Dross Chiller Baghouse Dust) | Off-site Solid Waste Landfills |
| | Chlorine Gas, Dry Fluxes, Mineral Fibers | Furnace Dross | Off-site Dross Recycler, or On-site Landfill (1) | Off-site Dross Recycler Recovers Free Metal (returned to Cast House), Residuals to Solid Waste Landfill |
| **Scalping (scalped ingots)** | Aluminum Ingots | Scalped Aluminum Scrap | Recycled to Cast House | Recycled to Cast House |

**Table 2-1**
**Review of Waste Generation and Management**

| PLANT AREA (end product) | RAW MATERIALS | WASTES GENERATED | KNOWN PAST MANAGEMENT | CURRENT MANAGEMENT |
|---|---|---|---|---|
| **Fabrication Plant (continued)** | | | | |
| **Hotline (rolled aluminum plates and coils)** | Scalped Ingots | Trimmed and Sheared Aluminum Scrap | Recycled to Cast House | Recycled to Cast House |
| | Groundwater [Demineralizer Process] | Demineralizer Filter Resins | On-site Landfill (1) | Off-site Solid Waste Landfill |
| | | Regeneration Wastewater | Neutralized in a Tank and Discharged from NPDES Outfall (after 1975)(5) | Neutralized in a Tank and Discharged from NPDES Outfall |
| | Hotline Coolant (95% demineralized water and 5% oil emulsion) | Waste Coolant | Acid Break Process (pre-1971)<br>Oil Recovery Ponds (after 1971) | Oil Recovery Ponds |
| | | Filtered Solids and Sludges | Off-site Solid Waste Landfill | Off-site Solid Waste Landfill |
| **Plate Bays (aluminum sheet and plate)** | Rolled Aluminum | Trimmed and Sheared Aluminum Scrap | Recycled to Cast House | Recycled to Cast House |
| **Cold Mills (finished gauge aluminum coils)** | Aluminum Coils | Aluminum Scrap | Recycled to Cast House | Recycled to Cast House |
| | Coolant | Waste Coolant<br>Diatomaceous Earth Spent Filter Material | Recycled On-site<br>On-site Landfill (1) | Recycled On-site<br>Off-site Solid Waste Landfill |
| | Hydraulic Fluids | Used Hydraulic Fluids | Recycled On-site | Recycled Off-site |

Table 2-1
Review of Waste Generation and Management

| PLANT AREA (end product) | RAW MATERIALS | WASTES GENERATED | KNOWN PAST MANAGEMENT | CURRENT MANAGEMENT |
|---|---|---|---|---|
| **Fabrication Plant (continued)** | | | | |
| **Finishing**<br>**(finished sheet, plate and coil)** | Aluminum Coil, Sheet and Plate | Trimmed and Sheared Aluminum Scrap | Recycled to Cast House | Recycled to Cast House |
| | Coolant/Lubricant | Waste Coolant/Lubricant | Recycled On-site | Recycled and Reused On-site |
| | Post Lube (on canstock) | Drippings Into Sumps | Recycled Off-site | Recycled Off-site |
| | Hydraulic Fluids | Used Hydraulic Fluids | Recycled On-site | Recycled Off-site |
| **Fabrication and Reduction Plants** | | | | |
| **Maintenance and Machine Shops (maintenance and repairs)** | Motor Oils and Hydraulic Oils | Used Motor Oils and Hydraulic Oils | Fuel for Industrial Boiler (after 1974) (5) | Recycled Off-site |
| | Greases | Waste Grease and Oily Wastes | Shipped Off-site for Solidification and Landfilling (after 1992) (5) | Shipped Off-site for Solidification and Landfilling |
| | New Parts and Materials;<br>Welding Rods<br>Parts Cleaners | Scrap Iron, Steel and Wire;<br>Welding Rodstubs<br>Used Mineral Spirits | Recycled, or Off-site Landfill (1)<br>Off-site Recycler | Scrap Recycler<br><br>Off-site Energy Recovery |

**Table 2-1**
**Review of Waste Generation and Management**

| PLANT AREA (end product) | RAW MATERIALS | WASTES GENERATED | KNOWN PAST MANAGEMENT | CURRENT MANAGEMENT |
|---|---|---|---|---|
| **Fabrication and Reduction Plants (continued)** | | | | |
| **Fabrication and Reduction Laboratories (QC analyses of raw materials and products)** | Samples, Reagents, Glassware, etc. | Off-Specification and Spent Chemicals | Manifested Off-site as Hazardous Waste (5) (after 1989) | Manifested Off-site as Hazardous Waste Laboratory Packs (if appropriate) |
| | | | Neutralized and Discharged (2) through NPDES Outfall | Neutralized and Discharged (2) through NPDES-Permitted Outfall |
| | | Sample Residues | On-site Landfill (1) | Off-site Solid Waste Landfill |
| | | Broken Glassware and Equipment | On-site Landfill (1) | Off-site Solid Waste Landfill |
| **Various Plant Areas** | Supplies, Tools, Parts, Paper, Shipping and Packing Materials, etc. | General Solid Wastes: (including those items listed in Note (4) ) | On-site Landfill (1) | Recycling (where feasible), or Off-site Solid Waste Landfill |
| | Paints, Solvents, Mineral Spirits | Waste Paints, Solvents, and Mineral Spirits | Manifested Off-site as Hazardous Waste (after 1989) (5) | Manifested Off-site as Hazardous Waste |

Notes:
(1) The On-site Landfill was closed in November 1992.
(2) Inorganics and acids/bases
(3) Organics (no chlorinated organics).
(4) Plastic, brake tools, construction/demolition waste, pallets, cardboard, paper glass, lunch waste, debris, miscellaneous trash, respirator cartridges, gloves, mud buckets, Tyvek suits, oily rags, air and oil filters, clutch plates, tires, brake shoes, spark plugs, etc.
(5) Waste management not documented before indicated date.

## Table 2-2
## Water Level Elevations - January 18, 1996

| WELL NO. | TOP of CASING ELEVATION (feet) | WATER LEVEL (feet below TOC) | WATER ELEVATION (feet) |
|---|---|---|---|
| DM-1 | 626.99 | 69.16 | 557.83 |
| DM-2 | 627.32 | 69.57 | 557.75 |
| DM-3 | 607.14 | 48.65 | 558.49 |
| DM-4 | 606.25 | 47.82 | 558.43 |
| DM-5 | 624.37 | 67.06 | 557.31 |
| DM-7 | 618.82 | 60.85 | 557.97 |
| DM-8 | 599.62 | 41.09 | 558.53 |
| DM-9 | 627.88 | 69.45 | 558.43 |
| DM-10 | 630.69 | 72.59 | 558.10 |
| GM-1 | 626.17 | 67.59 | 558.58 |
| GM-2 | 627.17 | 68.69 | 558.48 |
| GM-3 | 626.78 | 68.17 | 558.61 |
| GM-4 | 626.65 | 67.83 | 558.82 |
| GM-5 | 621.62 | N/A | N/A |
| GM-6 | 623.55 | 64.63 | 558.92 |
| GM-7s | 621.76 | N/A | N/A |
| GM-7d | 621.35 | 62.55 | 558.80 |
| GM-8 | 601.30 | 42.31 | 558.99 |
| WP-1 | 622.63 | N/A | N/A |
| WP-2 | 621.55 | N/A | N/A |
| WP-3 | 611.03 | N/A | N/A |
| WP-4 | 608.26 | 49.19 | 559.07 |
| IT-1s | 626.16 | N/A | N/A |
| IT-1i | 626.04 | 67.36 | 558.68 |
| IT-1d | 626.20 | 67.54 | 558.66 |
| IT-2 | 624.79 | N/A | N/A |
| IT-3 | 624.72 | 66.00 | 558.72 |
| RW-1 | 619.84 | N/A | N/A |
| W-1 | 604.40 | 46.09 | 558.31 |
| W-2 | 594.76 | 37.08 | 557.68 |
| W-3 | 604.68 | 47.00 | 557.68 |
| FT-1 | 582.63 | 23.21 | 559.42 |
| T-4 | 617.49 | 58.77 | 558.72 |
| T-5 | 582.31 | 23.79 | 558.52 |
| T-6 | 586.51 | 27.73 | 558.78 |
| T-8 | 618.92 | 59.57 | 559.35 |
| T-9 | 617.02 | 60.31 | 556.71 |
| RT-5 | 585.22 | 26.52 | 558.70 |
| Ohio River | 586.60 | 24.94 | 561.66 |
| MW-1 | 589.48 | 29.58 | 559.90 |
| MW-2 | 569.21 | 8.61 | 560.60 |
| MW-3 | 569.75 | 10.19 | 559.56 |
| MW-4 | 638.39 | 77.98 | 560.41 |
| MW-5 | 612.53 | 53.74 | 558.79 |
| MW-6 | 631.01 | 71.46 | 559.55 |
| MW-7 | 626.60 | 67.03 | 559.57 |

N/A - Well contains floating oil.

Shading indicates wells screened in the upper silt-clay deposits.

* - Surveyed elevations may not be accurate. Well casings have been damaged.

## Table 2-2
## Water Level Elevations - January 18, 1996

| WELL NO. | TOP of CASING ELEVATION (feet) | WATER LEVEL (feet below TOC) | WATER ELEVATION (feet) |
|---|---|---|---|
| MW-8d | 567.62 | 7.96 | 559.66 |
| MW-8s | 568.02 | 4.61 | 563.41 |
| LF-1 | 567.82 | 5.21 | 562.61 |
| LF-2 | 569.53 | 10.26 | 559.27 |
| LF-3 | 570.65 | 8.14 | 562.51 |
| LF-4 | 631.23 | 71.09 | 560.14 |
| LF-5 | 638.41 | 77.97 | 560.44 |
| LF-6 | 567.32 | 3.01 | 564.31 |
| LF-7 | 566.92 | 2.08 | 564.84 |
| K-101 | 574.26 | 12.85 | 561.41 |
| K-102 | 572.29 | 9.41 | 562.88 |
| K-103 | 574.57 | 10.40 | 564.17 |
| K-104s | 569.37 | 2.08 | 567.29 |
| K-104d | 569.50 | 8.01 | 561.49 |
| K-105 | 580.38 | DRY | -- |
| K-106 | 573.75 | 12.44 | 561.31 |
| K-107 | 566.52 | 1.73 | 564.79 |
| K-108 | 570.80 | 6.41 | 564.39 |
| K-201 | 570.60 | 2.93 | 567.67 |
| K-202 | 569.85 | 2.58 | 567.27 |
| K-203 | 571.26 | 5.95 | 565.31 |
| K-204 | 573.45 | 11.64 | 561.81 |
| K-205 | 575.51 | 14.09 | 561.42 |
| K-206 | 576.31 | 15.19 | 561.12 |
| K-207 | 574.49 | 13.43 | 561.06 |
| K-208 | 571.28 | 7.47 | 563.81 |
| K-209 | 570.12 | 2.02 | 568.10 |
| TW-1 | 593.98 | 34.98 | 559.00 |
| A | 572.27 | 10.16 | 562.11 |
| B | 572.13 | 10.85 | 561.28 |
| C | 573.57 | 11.73 | 561.84 |
| D | 569.03 | 8.23 | 560.80 |
| E | 569.84 | 8.57 | 561.27 |
| F | 575.91 | 14.84 | 561.07 |
| G | 572.59 | 11.11 | 561.48 |
| F-8-OW | 598.58 | 40.18 | 558.40 |
| F-9-OW | 595.94 | 38.17 | 557.77 |
| PZ-1 | 576.69 | 16.75 | 559.94 |
| F-6 | 633.84 | 75.26 | 558.58 |
| R-5TW | 584.35 | 25.78 | 558.57 |
| RT-2.5 | 575.01 | 15.15 | 559.86 |
| RT-3.5* | 587.99 | 28.62 | 559.37 |
| RT-3.75* | 588.48 | 27.79 | 560.69 |

N/A - Well contains floating oil.

Shading indicates wells screened in the upper silt-clay deposits.

* - Surveyed elevations may not be accurate. Well casings have been damaged.

## Table 2-3
## Water Level Elevations
## August 28, 1997

| WELL NO. | TOP of CASING ELEVATION (feet) | DEPTH to WATER (ft below TOC) | WATER LEVEL ELEVATION (feet) |
|---|---|---|---|
| DM-1 | 626.99 | 68.89 | 558.10 |
| DM-2 | 627.32 | 70.16 | 557.16 |
| DM-3 | 607.14 | 48.50 | 558.64 |
| DM-4 | 606.25 | 47.62 | 558.63 |
| DM-5 | 624.37 | 67.38 | 556.99 |
| DM-7 | 618.82 | 60.78 | 558.04 |
| DM-8 | 599.62 | 41.11 | 558.51 |
| DM-9 | 627.88 | 70.61 | 557.27 |
| DM-10 | 630.69 | 72.30 | 558.39 |
| GM-1 | 626.17 | 67.40 | 558.77 |
| GM-2 | 627.17 | 68.54 | 558.63 |
| GM-3 | 626.78 | 68.02 | 558.76 |
| GM-4 | 626.65 | 67.73 | 558.92 |
| GM-5 | 621.62 | 62.55 | 559.07 |
| GM-6 | 623.55 | 64.51 | 559.04 |
| GM-7s | 621.76 | 63.99 | 557.77 |
| GM-7d | 621.35 | 62.44 | 558.91 |
| GM-8 | 601.30 | 42.25 | 559.05 |
| WP-1 | 622.63 | 66.01 | 556.62 |
| WP-2 | 621.55 | 63.61 | 557.94 |
| WP-3 | 611.03 | 52.20 | 558.83 |
| WP-4 | 608.26 | 49.12 | 559.14 |
| IT-1s | 626.16 | 68.02 | 558.14 |
| IT-1i | 626.04 | 67.19 | 558.85 |
| IT-1d | 626.20 | 67.39 | 558.81 |
| IT-2 | 624.79 | 66.18 | 558.61 |
| IT-3 | 624.72 | 65.94 | 558.78 |
| RW-1 | 619.84 | NOT LOCATED | NA |
| W-1 | 604.40 | 46.03 | 558.37 |
| W-2 | 594.76 | NOT ACCESSIBLE | NA |
| W-3 | 604.68 | 46.30 | 558.38 |
| FT-1 | 582.63 | 23.20 | 559.43 |
| T-4 | 617.49 | 58.69 | 558.80 |

Shading indicates wells screened in upper silt-clay deposits.

NA - Not applicable.

NM - Not measured.

NU - not utilized. Well screened across two district lithologic units

() - Water level measurements invalidated by verification measurements collected October 16, 1997.

## Table 2-3
## Water Level Elevations
## August 28, 1997

| WELL NO. | TOP of CASING ELEVATION (feet) | DEPTH to WATER (ft below TOC) | WATER LEVEL ELEVATION (feet) |
|---|---|---|---|
| T-5 | 582.31 | 23.59 | 558.72 |
| T-6 | 586.51 | NOT LOCATED | NA |
| T-8 | 618.92 | 58.41 | 560.51 |
| T-9 | 617.02 | 60.08 | 556.94 |
| RT-5 | 585.22 | NOT LOCATED | NA |
| Ohio River | 586.60 | 0.70 | 585.90 |
| MW-1R | 589.48 | 31.41 | 558.07 |
| MW-2 | 569.21 | 9.33 | 559.88 |
| MW-3 | 569.75 | 10.72 | 559.03 |
| MW-4 | 638.39 | 78.28 | 560.11 |
| MW-5 | 612.53 | (53.47) | (559.06) |
| MW-6 | 631.01 | 71.35 | 559.66 |
| MW-7 | 626.60 | 66.99 | 559.61 |
| MW-8d | 567.62 | 8.22 | 559.40 |
| MW-8s | 568.02 | 8.05 | 559.97 |
| MW-9 | 621.49 | 64.00 | 557.49 |
| LF-1 | 567.82 | NU | NA |
| LF-2 | 569.53 | 9.30 | 560.23 |
| LF-3 | 570.65 | 10.59 | 560.06 |
| LF-4 | 631.23 | 71.09 | 560.14 |
| LF-5 | 638.41 | 78.00 | 560.41 |
| LF-6 | 567.32 | 6.70 | 560.62 |
| LF-7 | 566.92 | 4.72 | 562.20 |
| K-101 | 574.26 | 13.75 | 560.51 |
| K-102 | 572.29 | 11.18 | 561.11 |
| K-103 | 574.57 | 14.05 | 560.52 |
| K-104s | 569.37 | 2.55 | 566.82 |
| K-104d | 569.50 | 9.30 | 560.20 |
| K-105 | 580.38 | NU | NA |
| K-106 | 573.75 | 13.28 | 560.47 |
| K-107 | 566.52 | 4.78 | 561.74 |
| K-108 | 570.80 | 9.04 | 561.76 |
| K-201 | 570.60 | 4.53 | 566.07 |
| K-202 | 569.85 | 7.02 | 562.83 |

Shading indicates wells screened in upper silt-clay deposits.

NA - Not applicable.

NM - Not measured.

NU - not utilized. Well screened across two district lithologic units

() - Water level measurements invalidated by verification measurements collected October 16, 1997.

## Table 2-3
## Water Level Elevations
## August 28, 1997

| WELL NO. | TOP of CASING ELEVATION (feet) | DEPTH to WATER (ft below TOC) | WATER LEVEL ELEVATION (feet) |
|---|---|---|---|
| K-203 | 571.26 | NU | NA |
| K-204 | 573.45 | 13.45 | 560.00 |
| K-205 | 575.51 | (17.20) | (558.32) |
| K-206 | 576.31 | 15.90 | 560.41 |
| K-207 | 574.49 | 14.28 | 560.21 |
| K-208 | 571.28 | NU | NA |
| K-209 | 570.12 | NU | NA |
| TW-1 | 593.98 | NOT LOCATED | NA |
| A | 572.27 | NM | NA |
| B | 572.13 | 12.03 | 560.10 |
| C | 573.57 | 13.03 | 560.54 |
| D | 569.03 | 9.26 | 559.77 |
| E | 569.84 | 9.73 | 560.11 |
| F | 575.91 | 15.75 | 560.16 |
| G | 572.59 | 12.44 | 560.15 |
| F-8-OW | 598.58 | 40.46 | 558.12 |
| F-9-OW | 595.94 | 38.84 | 557.10 |
| PZ-1 | 576.69 | 17.03 | 559.66 |
| F-6 | 633.84 | 74.98 | 558.86 |
| R-5TW | 584.35 | NOT LOCATED | NA |
| RT-2.5 | 575.01 | TOC BROKEN | NA |
| RT-3.5 | 587.99 | NOT LOCATED | NA |
| RT-3.75 | 588.48 | TOC BROKEN | NA |

Shading indicates wells screened in upper silt-clay deposits.

NA - Not applicable.

NM - Not measured.

NU - not utilized. Well screened across two district lithologic units

() - Water level measurements invalidated by verification measurements collected October 16, 1997.